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(71) Applicant: SCIENTIFIC-ATLANTA, INC. [US/US]; Intellectual Property Dept., Barnhardt, Hubert, J., III, One Technology Parkway South, Norcross, GA 30092 (US).

(72) Inventors: JERDING, Dean, F.; 315 Seventeenth Fwy., Roswell, GA 30076 (US). RODRIGUEZ, Arturo, A.; 5315 Abigail Lane, Norcross, GA 30092 (US). SCHLARB, John, M.; 2040 North Creek Circle, Alpharetta, GA 30004 (US).

(74) Agents: BARNHARDT, Hubert, J., III et al.; Scientific-Atlanta, Inc., Intellectual Property Dept., One Technology Parkway South, Norcross, GA 30092 (US).

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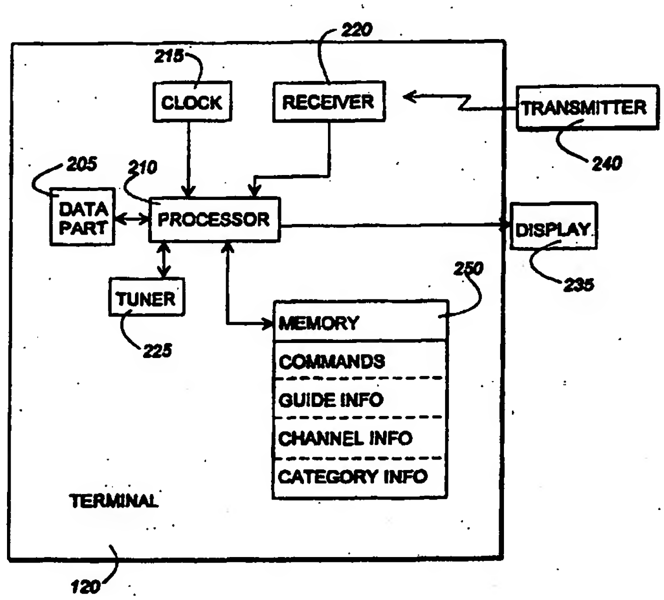

(57) Abstract

A system and method of providing for displaying a full service cable television system. The cable television system is adapted to provide a plurality of different user services. Accordingly, the system and method are designed to allow a user to access services in an efficient memory conserving fashion. Using a plurality of different services including cable channels, interactive program guides, pay per view activation, video on demand and interactive online services such as world wide web browsing and E-mail via their home television set.

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SYSTEM AND METHOD FOR PROVIDING A PLURALITY OF PROGRAMMING SERVICES IN A TELEVISION SYSTEM

Technical Field

This invention relates in general to television systems, and more particularly to a system and architecture for providing a plurality of different classes of video and multimedia programming and including the logical interface method for accessing said plurality of video and multimedia services.

Background of the Invention

The old definition of television services included a channel which was essentially nothing more than an analog broadcast video source. However, in the brave new world of digital programming, the home communication terminal ("HCT") otherwise known as the settop box has become a more powerful computing device than the typical analog cable TV set-top. In addition to supporting traditional analog broadcast video and functionality, these devices must also support an increasing number of services which are not analog (but rather digital), are not broadcast (two-way communication as for example E-mail), and are not video (such as web browser). These are all in addition to a host of other television services which are increasingly being demanded by customers, examples of which include audio and audio visual programming, advanced navigation controls, interactive program guides, impulse pay-per-view

captivation, video on demand programming, advanced configuration controls, and other online services to name but a few. In order to provide these more powerful and complex features, the simple channel abstractions need to be extended beyond those which have traditionally been provided.

With the capabilities of advanced one-way digital networks, a multiplicity of applications become feasible such as downstream e-mail delivery, electronic magazines, electronic newspapers, and other graphical and textual services for news, sports and financial information, to name but a few of broadcast authorizable services. With the capabilities of a two-way, digital network other applications such as impulse pay-per-view, video on demand, electronic commerce and web browsing become possible. All these services can be offered in parallel with conventional broadcast television and can be considered differing service categories. As the number of services available via cable or satellite television increases, there is a need for a model in which the television viewer can access these services. Given that a viewer of newer generation digital HCTs can access up to thousands of channels and services available, there will be a large amount of service and channel definition information that needs to be transmitted from the headend or server location to the client or HCT. Traditional methods of broadcast television and services in cable television systems do not provide the necessary amounts of information to support all these channels and services, nor are they capable of efficiently transmitting, storing,

accessing, and processing the corresponding large amounts of information in the HCT.

Cost limitations on HCT manufacture impose limitations in compute, memory, and internal machine bus bandwidth that in turn limit the amount of compute resources required to implement increasing digital video and multimedia functionality. Consequently, it would be desirable to provide a system in which required service related information is transmitted from the headend to the HCT in a methodical fashion so as to minimize: required network transmission bandwith; time to organize the information for storage in the HCT; memory footprint of the information in the HCT; and the amount of time required to then access the information in the HCT. Additionally, this information must be updated in an efficient manner such as that when the services and channel lineup are changed the HCT is provided the new information.

It would also be desirable to provide this system and method in which a particular application for a specific service is preloaded on the HCT and, if not, arrange for it to be acquired from the headend and loaded. This, of course, would require the ability to have two-way digital cable TV network for communication between the headend and the HCT, or an advanced one-way digital network in which system and method acquires specific broadcast service information by accessing and retrieving data with a predetermined file name and identification, such file retrieved from a broadcast file system ("BFS").

Accordingly, there exists a need to provide a mechanism whereby applications on the HCT can be activated from the server via a signaling message received from the HCT, to provide the user with services such as Emergency Alert Messages, email, and other messaging.

Brief Description of the Drawings

FIG. 1 is a block diagram of a cable television system in accordance with the present invention;

FIG. 2 is an electrical block diagram of a settop terminal included in the cable television system FIG. 1, in accordance with the present invention;

FIG. 3 is a block diagram service application manager service table for a cable television system, in accordance with the instant invention;

FIG. 4 is a block diagram representation of the display channel table used in connection with the service application manager of the instant invention;

FIG. 5 is a block diagram representation of a split channel table used in connection with the service application manager, in accordance with the instant invention;

FIG. 6 is a block diagram representation of a bulk table used in connection with the service application manager in accordance with the instant invention; and

FIG. 7 is a block diagram representative of a logo table used in connection with the service application manager, in accordance with the instant invention.

Detailed Description of the Preferred Embodiments

While the specification concludes with claims defining the features of the invention that are regarded as novel, it is believed that the invention would be better understood from a consideration of the following description in conjunction with the drawing figures in which like reference numerals are carried forward.

Referring now to FIG. 1 there is illustrated therein a block diagram of a cable television system 100 including a headend 105 for receiving satellite television signals, demodulating the signals down to base band, and transmitting the signals over the system 100. The transmitted signals can, for instance, be radio frequency (RF) signals, although they may more preferably be optical signals that are transmitted over a communications medium such as a fiber optic cable 125. When optical signals are transmitted by the headend 105, one or more nodes 110 are included in the system 100 for converting the optical signals to RF signals that are thereafter routed over other media such as coaxial cables 130. Taps 115 are provided within the cable system 100 for splitting the RF signal off to subscriber equipment, such as settop terminals 120, cable ready televisions, video cassette recorders (VCRs) or computers.

Referring now to FIG. 2, there is illustrated therein a block diagram of the home communication terminal 120 and other system equipment is shown. The terminal 120 is typically situated within the residence or business of a subscriber. It may be integrated into a device that has a display 235, such as a television set, or it may be a stand alone unit that couples to an external display, such as a display included in the computer or a television, and that processes television signals for presentation to subscriber on the display. The terminal 120 preferably comprises a data port 205 for receiving the RF signals, which can include video, audio and data information, from the tap and providing any reverse information to the tap for transmission back to the headend. The terminal 120 further includes a processor 210 for controlling operations of the terminal 120 and for driving the display, a clock 215 for providing timing functions, and a tuner 134 for tuning into a particular audio, video, and/or data channel. Additionally, the terminal 120 includes a receiver 220 for receiving externally generated information, such as viewer inputs or commands from other devices. Viewer inputs could, for example, be provided via transmitter 240, such as buttons or keys located on the exterior of the terminal 120 or a handheld remote control device that includes user actuated buttons. Additionally, in certain embodiments, terminals include interface connectors for Ethernet port, Serial port, and Universal Serial Bus port.

A memory 250, such as a nonvolatile volatile random access memory, coupled to the processor stores operational parameters such as

commands that are recognized by the processor. The memory also stores program and application information that can, for instance, be downloaded over the system to the terminal. The program information includes program guide information that is displayed for the subscriber in the format of a program guide including a listing of channels, programs for viewing on the channels, and times during which the programs are shown. The program information also includes channel information such as the channel number and identification information, e.g., ESPN, Disney, WXIA, etc.

As noted above, in the world of digital programming, services are no longer considered to be simply traditional analog broadcast services, but will include advanced one-way digital network services and a whole host of additional two-way services such as web browsing, video on demand, and E-mail to name but a few. In order to provide these more powerful and complex features, the simple channel abstraction needs to be extended so as to provide for each of these different services in both one-way and two-way digital networks. The instant invention provides a Service Application Manager ("SAM") system and method that implements a model in which a viewer can access services. Each service identification consists, for example, of an application to run and a parameter, such as data content, specific to that service. Many services may be defined using the same application component, however with different parameters. For example, an application that can tune video programming would be executed with one set of parameters to view, for example, HBO, and a

separate set of parameters to view, for example, CNN. Each association of the application components (in this case tune video) and one of the parameter components (i.e., HBO or CNN) represents a particular service that has a unique service identification. Each of the other services described above, such as text channels, pay-per-view, video on demand and web browsing fit nicely within the service model. In addition to an application and parameter, each service also has an identity, which may include a short textual description (such as call letters for a particular television station), a long textual description, and a logo image.

Additional service attributes in certain embodiments include multimedia service attributes. A service's identity is optionally augmented with an introductory audio that is played when the service is launched. A short "Welcome to ABC" song or voice with musical background, where such audio is distinctively associated with service is an example. Likewise, a service's identity is optionally augmented with an audio for when service is terminated or suspended.

In other embodiments, a special effect when starting a service, including animated transition into the service such as morphing from an image of service logo to displayable service, or graphics transitions such as implosion and fades, may be associated with the service. Likewise, a special effect may be associated with a service when it is terminated or suspended.

In another embodiment, any of a partial or full-size image, video or video widget serving the function of a 3-D logo is associated with a service

and displayed momentarily when service is launched. Same or different counterpart media is employed for service termination or suspension. The specified association of media with service may include an amount of time to display or play the media. Additionally, media can be combined with special effects.

Service attributes may or may not necessarily be for identification services but for efficiency of system and method. Such service attributes include: cable-operator-only launchable service messaging viewer with emergency alerts or reminders to pay bill. A service can be classified with an attribute as both, a cable-operator and viewer, launchable service. Alternately, a service attribute is an installer-only or repair-representative-only launchable service.

A service can be classified with an attribute as one that can be launched by time, rather than immediately to responding to viewer input or headend signaling. Furthermore, such service activation time is designated by:

A. a prespecified time after viewer activation or server signaling; or

B. input by viewer or data transmitted during server signaling, and/or possibly with:

1. periodic pre-specified interval values; or
2. periodic pre-specified interval values specified by viewer or headend message.

Examples of a service that is launched periodically is a ticker-tape that displays periodic information updates of sports scores or stock prices. Specification of service display duration is included appropriately in the aforementioned. A service can also be classified with an attribute as a "service not-blockable by viewer" that is activated by cable headend operator.

A service may have the attribute of a background-service, not visible to viewer. In a HCT, a service that enables HCT to route Internet Protocol data or other information received from and to digital network and passed via one of many possible HCT communication ports to and from one or more of many computing devices in the viewer's premises, establishes a communication link between the digital network and computing devices. Such computing devices include an advanced phone, a hand-held electronic organizer device, a personal computer, an appliance such as a stove, and therefore the HCT acts as a cable modem.

Although a service runs in the HCT in the forementioned, the application running on the HCT serves as an "enabler" and possibly as a communication switch while the designated computing device and communication port are specified as parameters of the service. HCT communication ports include Ethernet port, serial port, Universal Serial Bus (USB), to name a few.

In order to access this growing number of services, it is necessary to provide a system which can meet functionality, efficiency, and memory footprint requirements constrained by the capabilities of the HCT. The

Service Application Manager ("SAM") architecture consists of a SAM server component, a SAM client component, and the interface between-the server to the client. This interface consists of the SAM information tables broadcast on the BFS (an example of which is disclosed in commonly assigned patent application serial no. PCT/US97/22535, the disclosure of which is incorporated herein by reference) and the update and signaling messages passed from server to client. In the context of the system illustrated in Figs. 1 and 2, the SAM server component is part of the headend, while the SAM client component resides in the HCT. The SAM server stores the current SAM information which consists of a Service Table, a Display Channel Table, a Split Channel Table, the Bulk Table, and the Logo Table. The SAM provides an interface for a server operator to enter and modify the information on the SAM, and to broadcast it to SAM clients notifying them of, for example, information changes. The SAM also allows the applications which execute a particular service to be introduced into the system. Each application has a server component and a client component. The application server may execute all the time, while an application client may be downloaded to the HCT and executed only when the viewer requests the service be activated.

The SAM server provides an interface through which applications are placed on the network, services registered, a channel lineup specified, and the SAM information stored and modified. The SAM server may also allow changes to the SAM information table (as described herein below) to

be posted to the network together with a time specified by the cable operator.

The SAM client provides an interface through which applications may be activated and SAM information can be accessed. One functionality of the SAM client is the activation of an application client on the HCT, either to provide a specified service or because of a signaling message from the server.

As noted above SAM information includes at least five different tables: a Service Table stores information about all services available on the system and each service is identified by a specific service ID; a Display Channel Table ("DCT") provides an abstraction to match a display channel number to a service ID (and vice versa); a Split Channel Table supplements the DCT with information about split channels; a Bulk Table is provided for storing actual string and parameter data as well as attributes of each service. The data for each table may be transmitted from the server to the client by writing it into a binary file and then placing the file on a broadcast file system ("BFS") such as that disclosed in the aforementioned copending PCT Patent Application, the disclosure of which is incorporated herein by reference. Updates to the various table increments the tables' version number. Accordingly, the system will always access the most recent version of a particular table. This is important as some channels, for example the Split Channel Table, will change fairly regularly and indeed can change on a daily basis.

When the SAM server changes the SAM files being broadcast on BFS, the SAM client will receive a message from the SAM server via the HCT operating system. This message contains the current version number of each SAM table, as well as flags optionally specifying a "forced" update of each table. For each table, the SAM client will check the version number specified in the message versus the local table versions and only if they are different retrieve the file from the BFS and check the version number a second time (unless the "force" flag is set for that table, in which case the file on BFS is always checked). If a file version being transmitted on the BFS is different than the local file stored in the SAM client, the SAM client will update its tables using the new files.

The update process works such that while the SAM client is reading new files, the old files are still available to applications on the HCT. Only when the SAM client has completed reading any new tables does it actually update the current tables to the new information. During this very brief "swap", both old and new tables are locked such that the data cannot be accessed via the SAM client interface.

The update process is also robust such that the SAM client can handle the various non-deterministic aspects of the SAM server's use of the BFS. For example, the synchronization of the message being received at the client, the file being changed on the BFS server, and the file being changed as seen by the BFS client are all affected by network latency and could happen in different orders.

After receiving an information update, the SAM client will notify interested applications via the HCT OS that the SAM information has changed. To allow other components to update their service and channel related information, the SAM client must keep the last version of the replaced data tables in memory.

The various SAM information tables are transmitted in band, over QAM, for fast access by the SAM client during HCT boot. Copies of the tables, with the exception of the Logo Table, are also transmitted out-of-band, over QPSK. The out of band files are used by the SAM client during SAM information update such that the viewer's use of the HCT is not interrupted (access to in-band data requires use of the HCT tuner).

Referring now to FIG. 3 there is a block diagram representation of the Service Table used in the preferred embodiment of the Service Application Manager, all in accordance with the instant invention. The Service Table 300 contains the service identification information, with each service assigned a unique service ID. The header information at the beginning of the Service Table includes the table version 308 and the number of sub tables 310. This is followed by the service subtables. Each subtable 302 includes the number of subtable entries, the length of the service data segment, an index, and finally the service data segment. The index includes a pairing of a service ID and the offset into the data segment where the service data is actually found. Accordingly, if a particular subtable provides information relating to 25 different services, the index will include 25 blocks, each block corresponding to a single

service. The service IDs 306 across the entire Service Table are stored in increasing order, but are not necessarily contiguous. Each service subtable can store up to 64Kb of service data.

To find a service ID in the Service Table, a binary search is done first on the subtables to determine which subtable a service ID is in, and then within the index of the subtable to locate the offset of the service data in that subtable. The offset is then used to access the data directly.

Each service data record includes all of the service attributes. One such attribute is a description ID. The description ID is an index into the Bulk Table for the string describing the service. In one embodiment, each string is made up of three fields: (1) an ascii string decimal number specifying the length of the short description in characters; (2) a short description ascii string; and (3) a long description ascii string. For example, the following strings describe a service whose short description is "WTHR", and the long description is "The Weather Channel": "4WTHR The Weather Channel."

A second piece of data which is located in the data block 320 is a logo ID and which itself is an index into the Logo Table for the service's logo pixel map. An application Universal Resource Locator ("URL") ID is a third index into the Bulk Table for the URL string identifying the application client in the broadcast file system. The final attribute is an application dependent parameter, which is interpreted as a number (i.e., a source ID) or an index into the Bulk Table for a parameter string or parameter data.

In order to efficiently store service records for thousands of services, the invention specifies a record with variable-length fields. The idea is to use only as much memory for a field as is needed for the particular value of that field. The field Size attribute of the service is used to specify the size, in bytes, of each field. The field Size byte uses 2 bits to encoding the number of bytes minus 1 for each field. A value of "00" in a field means it is 1 byte, "01" means 2 bytes, etc. No matter what the actual field size, the access operations always return the field value in 32 bits. The access routines must operate at a byte level when retrieving fields larger than a byte because the data will not be word or half-word aligned. The format of the field Size byte is shown below:

```
field Size:    for(i = bit 0; i < 8; i++)  {
                        description ID size - 1 : 2
                        logoId size - 1 : 2
                        applicationId size - 1 : 2
                        parameter size - 1 : 2
               }
```

Thus, each record varies in length from 5 to 17 bytes.

Accordingly, and referring now to FIG. 4, there is illustrated therein in a block diagram representation of the Bulk Table used in connection with the Service Application Manager, all in accordance with the instant invention. The Bulk Table 400 contains data relevant to the services, such as strings for descriptions, application URLs, and parameter data. As with the Service Table 300 of FIG. 3, the Bulk Table comprises several

initial entries 402, 404 as described above, followed by a plurality of bulk information subtables 406 and 408.

Each subtable includes the number of subtable entries, the length of the bulk data segment, an index, and finally the bulk data segment. The index includes a pairing of a bulk ID and the offset into the data segment where the bulk data is actually found. Accordingly, if a particular subtable provides information relating to 25 different bulk data entries, the index will include 25 blocks, each block corresponding to a single bulk data item. The bulk IDs across the entire Service Table are stored in increasing order, but are not necessarily contiguous. Each bulk subtable can store up to 64Kb of bulk data.

To find a bulk ID in the Bulk Table, a binary search is done first on the subtables to determine which subtable a bulk ID is in, and then within the index of the subtable to locate the offset of the bulk data in that subtable. The offset is then used to access the data directly.

The size and the contents of the Bulk Table itself depends on the size and type of information which is required to be stored therein. Several types of BulkData are defined in the following. The application URL is simply a NULL-terminated ASCII string. The service description is two concatenated NULL-terminated ASCII strings, the first being the short description and the second being the long description. For example, "WGNX\0CBS Atlanta\0" is a possible description string. A string is simply a NULL-terminated ASCII string. Arbitrary data can be stored in the Bulk Table and a pointer to that data handed out via an API in the

SAM Client. It is then up to the application client to interpret the content of the data.

Referring now to FIG. 5, there is illustrated therein a block diagram representation of the Display Channel Table used in connection with the Service Application Manager, all in accordance with the instant invention. The Display Channel Table 500 is used to map service IDs to channel numbers displayed to the viewer (Display Channel Number, or DCN). In one embodiment of a cable system using the SAM, the Display Channel Table can be specified on a per-hub basis. This allows different neighborhoods of subscribers to receive different channel lineups.

The Display Channel Table is constructed to allow optimal access time to determine the service ID for a particular service or the service ID for a particular DCN. Both transformations are required by applications executing in the HCT such as the channel navigator and the program guide.

The Display Channel Table begins with a version number 502, the number of valid channels in the channel index 504, and the length of the valid service index 506. This is followed first by a valid channel bitmap 508, containing a bit for each channel in the cable system. For each channel that is valid, the corresponding bit position is set in the valid channel bitmap. Next is a valid channel index 510, each entry associated with a valid channel in the bitmap, whose content is an index into the service/DCN index that follows. The service/DCN index contains an entry

for each valid service ID and Display Channel Number pair. Within each Display Channel Number in that pair

is a channel flag (the most-significant-bit of the DCN). This flag indicates whether or not the DCN is surfable, i.e. can be reached by the user incrementing or decrementing throughout the channel lineup. There exists a service ID/DCN pair for every combination of service and DCN, where a service can be associated with more than one channel.

These data structures can be better understood by explaining how the translation for service ID to DCN and vice-versa takes place. To translate from DCN to service ID, first the bit for the DCN in the valid channel bitmap is checked. If the bit is set, the channel is valid, and the index for that channel must be determined. The index is exactly Nth valid channel which the DCN happens to be, or the number of bits set in the valid channel bitmap up to and including the bit representing the DCN. This lookup is made compute efficient by using a table which stores the number of bits set in a single byte for each decimal value of that byte. Thus, the channel index can be determined by taking the decimal value of each byte in the valid channel bitmap, translating the decimal value to a "number of bits set" using the lookup table, and accumulating this count for each byte in the valid channel bitmap up to the byte for the DCN. The remaining bits in the byte where the DCN bit is located are added by shifting and masking.

The number of bits set is then directly the Nth valid channel for that DCN, which is directly the offset into the channel index for that DCN.

The channel index contains the offset into the service/DCN index for that DCN. Once this offset is known, the service ID for that DCN is the upper two bytes of the 32-bit service ID/DCN value. The total search time is then O(n) where n is the number of total possible channels. This is achieved without having to store for example an array of size total number of channels, using only an array of size total number of channels divided by eight (the bitmap) plus an array of size number of valid channels.

To look up a service ID for a DCN, a binary search on the service ID/DCN index 512 is done. This index is sorted in increasing order, such that the search is O(log (number of valid service/DCN entries)).

In addition to the services described above, the SAM supports the ability to split channels provided over the system. A split channel is one in which there is more than one service which is provided on that channel during a 24 hour period. One embodiment of the SAM may support split channels, where each of which shows two services, and which may change between those two services up to three times in a 24 hour period. For example if the channel is specified as a split channel with service X and service Y, starting at midnight the following splits are available: XY, XYX, XYXY. Split channels are identified in the Display Channel Table in both the channel index and the service ID/DCN index using a reserved constant. This indicates to the SAM client to lookup the information for the requested DCN in the Split Channel Table. There is always a Split Channel Table for each Display Channel Table in which a split channel is identified.

Accordingly, referring now to FIG. 6, there is illustrated therein a block diagram representation a Split Channel Table 600 for use in connection with the Service Application Manager, all in accordance with the instant invention. The Split Channel Table, like the other tables, includes a number of initial entries such as initial entry 602 and 604. Initial entry 602 is version which specifies the most recent version of the split channel table allowing the SAM system to know that it is working with the most recent version of information. The second entry 604 specifies the number of split channels in the channel lineup. Accordingly, and in FIG. 6, the number of split channels identified would be one as only one split channel record 606 is illustrated in split channel table 600. It is to be understood, however, that any number of split channels may be supported by this system, and the invention is not so limited. The split channel record 606 includes a number of pieces of information, including, for example, the DCN being split 608, the identities of the services which are splitting the channel 610 and 612, and a time flag 614 which specifies the hours at which services are being provided on the channel. These times are specified such that service 1 is on by default at midnight in any given day. Each time then marks a swap to service 2 and back, continuing according to the number of swaps. The core channel management application in the HCT uses this information such that service swaps take place automatically and are done by the client. This differs from existing analog systems where split channels are implemented by changing the content which is broadcast on a particular analog channel. The split

channel concept in this invention also allows channels to be split between video services and services of other media, such as text channels or web browsing time.

The final SAM information table present in the instant invention is the Logo Table as illustrated in FIG. 7. The Logo Table 700 stores service logo data. The SAM server provides two different Logo Tables on the BFS, both transmitted in band. One table provides the default set of logos known by the SAM Server upon deployment of the cable system, in the present embodiment the range of default logo IDs is from 1-255 and is published including the name of the logo. The data for the default logo images can be stored in the nonvolatile memory of the HCT such that they can be retrieved very quickly and rendered by applications in the HCT. The set of default logos will never change, nor will the data in the default Logo Table.

New logos registered with services by the SAM server are stored in another Logo Table. The SAM client always loads this table into memory on the HCT during initialization, and it can be updated like any of the other SAM information tables. Accordingly, the Logo Table initial entry 702 relates to version numbers of the table.

All logos are encoded by the SAM Server using an encoder that translates a single common image format such as GIF into the particular format that the SAM is transmitting (and decoding within the SAM Client).

Application clients can access the logo data in the SAM in several ways. First, an application client can ask for the logo ID that corresponds to a particular service. If the logo ID is stored by the application client (one of the default logos), it can then draw the appropriate logo using its own data. Otherwise, the application client can ask the SAM client for the logo pixmap data, width, and height in a format compatible with the HCT OS drawing capabilities. A LogoId of zero means no logo.

The structure of the Logo Table begins with a version number 702, number of logos 704 in the table, first logo ID in the table 706, and then the size of the logo data 708. Next is an index of logo data offsets 710, such that index equals the logo ID minus the starting logo ID of the table. The index for a logo contains the offset into the logo data segment where the actual image data for the logo is stored.

The primary functionality of the SAM is the activation of an application client on the DHCT, either to provide a specified service or because of a signaling message from the server. Typically the user of the DHCT will access services via the Display Channel Number (DCN). The SAM uses the Display Channel Table (DCT) to map a DCN to a ServiceId. "Split" channels are supported, such that one channel might provide multiple services, depending on the time of day. Given a service ID, the SAM Client first extracts the appropriate application URL BulkDataId from the Service record in the current Service Table, and then the actual URL string from the Bulk Table. It then asks the HCT Operating System ("OS") if the module with the application URL for the application is loaded

in the HCT memory. If not, it requests that the OS load the module using the application URL. Once the application code is resident in the HCT, the SAM client launches the application module as an OS application (it may be that the application has already been launched). It then asks the OS to activate the application, given the module handle--this brings the application into focus. Finally, the SAM client sends a kEt_Activate message to the application client, including the service ID and the service parameter from the Service Table.

Application clients can also be activated by a message sent from the server. The SAM client must register with the HCT operating system to receive SAM signaling messages. The content of these messages is an application URL to activate and the data to pass the application as a parameter. The SAM client thus provides a mechanism whereby an application client can be activated given the application URL and some data. If the data type is an integer value, meaning the parameter itself, then it is passed directly to the application identified by the URL via a kEt_Activate message. However, if the parameter is a string or data, then it must be stored by the SAM client locally and given a BulkDataId in the range reserved for private client use. The SAM client will activate the application client. The BulkDataId is passed as the parameter, and a special id is used to signify a service activated via a pass-thru message. The application client can then use the SAM client API to retrieve the data given the bulk ID. Depending on the application, the private bulk data might be a URL string, an actual string to use directly, or data. The

application client must be given the parameter type it is expecting; this must be verified by the SAM Server before the signaling message is sent. However, if the application client is expecting a string it must check whether the string is a URL or the content itself. If the application client is executing on behalf of the kSam_SignalingService, then it must delete the private bulk data when it suspends

The SAM client can be asked to construct a kEt_Notify event with supplied parameters and forward it to designated application clients. Again, this can be done via a service ID or an application URL. The notification event type is supplemented with event data particular to the notification being sent (such as kEd_SamDataUpdated), an ID (typically the service ID), and two parameters.

The SAM client provides a facility whereby application clients can be queried to determine whether particular services are currently authorized. The SAM will look up the application URL for the requested service ID in the Service Table, and send the application client a kEt_IsAuthorized event requesting an asynchronous reply to a queue created within the SAM client API. The SAM client will wait on that queue until a kEt_AsyncResponse event is delivered by the application client, and then return the result to the caller of the SAM API. Thus, while the internals of the authorization query are asynchronous, the SAM Client API is synchronous. It is up to the application client to determine if the service is authorized, using whatever means necessary.

Application clients can be suspended by ServiceId or directly via application URL. Application clients can also be suspended as a result of a signaling message from the SAM Server.

Accordingly, in the system illustrated in Figs. 1 and 2 it may be appreciated that the channel selection function of this system includes a plurality of channel cross reference tables as illustrated in Figs. 3-7. These tables cross reference settop terminal channels with a variety of television services, or other services, such as various types of video and audio programming, and online services such as web casting and E-mail. Selection of a particular channel transfers control of that specific application program, along with one or more appropriate parameters obtained from the cross reference tables, and activates the service associated with that selected channel. In sum, the cross reference tables in Figs. 3-7 are channel selection functions which enable the settop terminals to execute software and activate a variety of services. When a viewer of the system of FIG. 1 selects a channel, the HCT identifies the service associated with the selected channel from the Display Channel Table and then executes the appropriate application determined from the Service Table of FIG. 3.

Further, channel and service lineup can take place transparently to the viewer based on the data kept in the SAM client. This is important as subscribers often group together in blocks favorite types of programming so as to make access to those programs easier. In other words, a subscribers mapping of the settop terminal channels to television services

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(71) Applicant: SCIENTIFIC-ATLANTA, INC. [US/US]; Intellectual Property Dept., Barnhardt, Hubert, J., III, One Technology Parkway South, Norcross, GA 30092 (US).

(72) Inventors: JERDING, Dean, F.; 315 Seventeenth Fwy., Roswell, GA 30076 (US). RODRIGUEZ, Arturo, A.; 5315 Abigail Lane, Norcross, GA 30092 (US). SCHLARB, John, M.; 2040 North Creek Circle, Alpharetta, GA 30004 (US).

(74) Agents: BARNHARDT, Hubert, J., III et al.; Scientific-Atlanta, Inc., Intellectual Property Dept., One Technology Parkway South, Norcross, GA 30092 (US).

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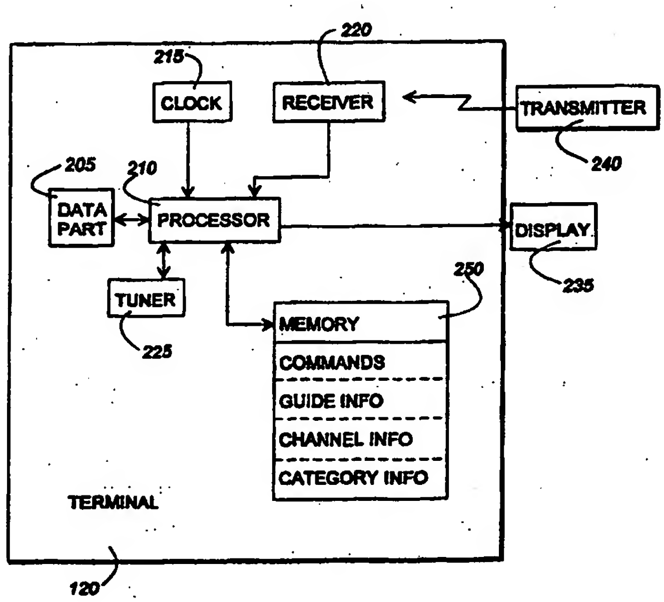

(57) Abstract

A system and method of providing for displaying a full service cable television system. The cable television system is adapted to provide a plurality of different user services. Accordingly, the system and method are designed to allow a user to access services in an efficient memory conserving fashion. Using a plurality of different services including cable channels, interactive program guides, pay per view activation, video on demand and interactive online services such as world wide web browsing and E-mail via their home television set.

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SYSTEM AND METHOD FOR PROVIDING A PLURALITY OF PROGRAMMING SERVICES IN A TELEVISION SYSTEM

Technical Field

This invention relates in general to television systems, and more particularly to a system and architecture for providing a plurality of different classes of video and multimedia programming and including the logical interface method for accessing said plurality of video and multimedia services.

Background of the Invention

The old definition of television services included a channel which was essentially nothing more than an analog broadcast video source. However, in the brave new world of digital programming, the home communication terminal ("HCT") otherwise known as the settop box has become a more powerful computing device than the typical analog cable TV set-top. In addition to supporting traditional analog broadcast video and functionality, these devices must also support an increasing number of services which are not analog (but rather digital), are not broadcast (two-way communication as for example E-mail), and are not video (such as web browser). These are all in addition to a host of other television services which are increasingly being demanded by customers, examples of which include audio and audio visual programming, advanced navigation controls, interactive program guides, impulse pay-per-view

captivation, video on demand programming, advanced configuration controls, and other online services to name but a few. In order to provide these more powerful and complex features, the simple channel abstractions need to be extended beyond those which have traditionally been provided.

With the capabilities of advanced one-way digital networks, a multiplicity of applications become feasible such as downstream e-mail delivery, electronic magazines, electronic newspapers, and other graphical and textual services for news, sports and financial information, to name but a few of broadcast authorizable services. With the capabilities of a two-way, digital network other applications such as impulse pay-per-view, video on demand, electronic commerce and web browsing become possible. All these services can be offered in parallel with conventional broadcast television and can be considered differing service categories. As the number of services available via cable or satellite television increases, there is a need for a model in which the television viewer can access these services. Given that a viewer of newer generation digital HCTs can access up to thousands of channels and services available, there will be a large amount of service and channel definition information that needs to be transmitted from the headend or server location to the client or HCT. Traditional methods of broadcast television and services in cable television systems do not provide the necessary amounts of information to support all these channels and services, nor are they capable of efficiently transmitting, storing,

accessing, and processing the corresponding large amounts of information in the HCT.

Cost limitations on HCT manufacture impose limitations in compute, memory, and internal machine bus bandwidth that in turn limit the amount of compute resources required to implement increasing digital video and multimedia functionality. Consequently, it would be desirable to provide a system in which required service related information is transmitted from the headend to the HCT in a methodical fashion so as to minimize: required network transmission bandwith; time to organize the information for storage in the HCT; memory footprint of the information in the HCT; and the amount of time required to then access the information in the HCT. Additionally, this information must be updated in an efficient manner such as that when the services and channel lineup are changed the HCT is provided the new information.

It would also be desirable to provide this system and method in which a particular application for a specific service is preloaded on the HCT and, if not, arrange for it to be acquired from the headend and loaded. This, of course, would require the ability to have two-way digital cable TV network for communication between the headend and the HCT, or an advanced one-way digital network in which system and method acquires specific broadcast service information by accessing and retrieving data with a predetermined file name and identification, such file retrieved from a broadcast file system ("BFS").

Accordingly, there exists a need to provide a mechanism whereby applications on the HCT can be activated from the server via a signaling message received from the HCT, to provide the user with services such as Emergency Alert Messages, email, and other messaging.

Brief Description of the Drawings

FIG. 1 is a block diagram of a cable television system in accordance with the present invention;

FIG. 2 is an electrical block diagram of a settop terminal included in the cable television system FIG. 1, in accordance with the present invention;

FIG. 3 is a block diagram service application manager service table for a cable television system, in accordance with the instant invention;

FIG. 4 is a block diagram representation of the display channel table used in connection with the service application manager of the instant invention;

FIG. 5 is a block diagram representation of a split channel table used in connection with the service application manager, in accordance with the instant invention;

FIG. 6 is a block diagram representation of a bulk table used in connection with the service application manager in accordance with the instant invention; and

FIG. 7 is a block diagram representative of a logo table used in connection with the service application manager, in accordance with the instant invention.

Detailed Description of the Preferred Embodiments

While the specification concludes with claims defining the features of the invention that are regarded as novel, it is believed that the invention would be better understood from a consideration of the following description in conjunction with the drawing figures in which like reference numerals are carried forward.

Referring now to FIG. 1 there is illustrated therein a block diagram of a cable television system 100 including a headend 105 for receiving satellite television signals, demodulating the signals down to base band, and transmitting the signals over the system 100. The transmitted signals can, for instance, be radio frequency (RF) signals, although they may more preferably be optical signals that are transmitted over a communications medium such as a fiber optic cable 125. When optical signals are transmitted by the headend 105, one or more nodes 110 are included in the system 100 for converting the optical signals to RF signals that are thereafter routed over other media such as coaxial cables 130. Taps 115 are provided within the cable system 100 for splitting the RF signal off to subscriber equipment, such as settop terminals 120, cable ready televisions, video cassette recorders (VCRs) or computers.

Referring now to FIG. 2, there is illustrated therein a block diagram of the home communication terminal 120 and other system equipment is shown. The terminal 120 is typically situated within the residence or business of a subscriber. It may be integrated into a device that has a display 235, such as a television set, or it may be a stand alone unit that couples to an external display, such as a display included in the computer or a television, and that processes television signals for presentation to subscriber on the display. The terminal 120 preferably comprises a data port 205 for receiving the RF signals, which can include video, audio and data information, from the tap and providing any reverse information to the tap for transmission back to the headend. The terminal 120 further includes a processor 210 for controlling operations of the terminal 120 and for driving the display, a clock 215 for providing timing functions, and a tuner 134 for tuning into a particular audio, video, and/or data channel. Additionally, the terminal 120 includes a receiver 220 for receiving externally generated information, such as viewer inputs or commands from other devices. Viewer inputs could, for example, be provided via transmitter 240, such as buttons or keys located on the exterior of the terminal 120 or a handheld remote control device that includes user actuated buttons. Additionally, in certain embodiments, terminals include interface connectors for Ethernet port, Serial port, and Universal Serial Bus port.

A memory 250, such as a nonvolatile volatile random access memory, coupled to the processor stores operational parameters such as

commands that are recognized by the processor. The memory also stores program and application information that can, for instance, be downloaded over the system to the terminal. The program information includes program guide information that is displayed for the subscriber in the format of a program guide including a listing of channels, programs for viewing on the channels, and times during which the programs are shown. The program information also includes channel information such as the channel number and identification information, e.g., ESPN, Disney, WXIA, etc.

As noted above, in the world of digital programming, services are no longer considered to be simply traditional analog broadcast services, but will include advanced one-way digital network services and a whole host of additional two-way services such as web browsing, video on demand, and E-mail to name but a few. In order to provide these more powerful and complex features, the simple channel abstraction needs to be extended so as to provide for each of these different services in both one-way and two-way digital networks. The instant invention provides a Service Application Manager ("SAM") system and method that implements a model in which a viewer can access services. Each service identification consists, for example, of an application to run and a parameter, such as data content, specific to that service. Many services may be defined using the same application component, however with different parameters. For example, an application that can tune video programming would be executed with one set of parameters to view, for example, HBO, and a

separate set of parameters to view, for example, CNN. Each association of the application components (in this case tune video) and one of the parameter components (i.e., HBO or CNN) represents a particular service that has a unique service identification. Each of the other services described above, such as text channels, pay-per-view, video on demand and web browsing fit nicely within the service model. In addition to an application and parameter, each service also has an identity, which may include a short textual description (such as call letters for a particular television station), a long textual description, and a logo image.

Additional service attributes in certain embodiments include multimedia service attributes. A service's identity is optionally augmented with an introductory audio that is played when the service is launched. A short "Welcome to ABC" song or voice with musical background, where such audio is distinctively associated with service is an example. Likewise, a service's identity is optionally augmented with an audio for when service is terminated or suspended.

In other embodiments, a special effect when starting a service, including animated transition into the service such as morphing from an image of service logo to displayable service, or graphics transitions such as implosion and fades, may be associated with the service. Likewise, a special effect may be associated with a service when it is terminated or suspended.

In another embodiment, any of a partial or full-size image, video or video widget serving the function of a 3-D logo is associated with a service

and displayed momentarily when service is launched. Same or different counterpart media is employed for service termination or suspension. The specified association of media with service may include an amount of time to display or play the media. Additionally, media can be combined with special effects.

Service attributes may or may not necessarily be for identification services but for efficiency of system and method. Such service attributes include: cable-operator-only launchable service messaging viewer with emergency alerts or reminders to pay bill. A service can be classified with an attribute as both, a cable-operator and viewer, launchable service. Alternately, a service attribute is an installer-only or repair-representative-only launchable service.

A service can be classified with an attribute as one that can be launched by time, rather than immediately to responding to viewer input or headend signaling. Furthermore, such service activation time is designated by:

A. a prespecified time after viewer activation or server signaling; or

B. input by viewer or data transmitted during server signaling, and/or possibly with:

1. periodic pre-specified interval values; or
2. periodic pre-specified interval values specified by viewer or headend message.

Examples of a service that is launched periodically is a ticker-tape that displays periodic information updates of sports scores or stock prices. Specification of service display duration is included appropriately in the aforementioned. A service can also be classified with an attribute as a "service not-blockable by viewer" that is activated by cable headend operator.

A service may have the attribute of a background-service, not visible to viewer. In a HCT, a service that enables HCT to route Internet Protocol data or other information received from and to digital network and passed via one of many possible HCT communication ports to and from one or more of many computing devices in the viewer's premises, establishes a communication link between the digital network and computing devices. Such computing devices include an advanced phone, a hand-held electronic organizer device, a personal computer, an appliance such as a stove, and therefore the HCT acts as a cable modem.

Although a service runs in the HCT in the forementioned, the application running on the HCT serves as an "enabler" and possibly as a communication switch while the designated computing device and communication port are specified as parameters of the service. HCT communication ports include Ethernet port, serial port, Universal Serial Bus (USB), to name a few.

In order to access this growing number of services, it is necessary to provide a system which can meet functionality, efficiency, and memory footprint requirements constrained by the capabilities of the HCT. The

Service Application Manager ("SAM") architecture consists of a SAM server component, a SAM client component, and the interface between-the server to the client. This interface consists of the SAM information tables broadcast on the BFS (an example of which is disclosed in commonly assigned patent application serial no. PCT/US97/22535, the disclosure of which is incorporated herein by reference) and the update and signaling messages passed from server to client. In the context of the system illustrated in Figs. 1 and 2, the SAM server component is part of the headend, while the SAM client component resides in the HCT. The SAM server stores the current SAM information which consists of a Service Table, a Display Channel Table, a Split Channel Table, the Bulk Table, and the Logo Table. The SAM provides an interface for a server operator to enter and modify the information on the SAM, and to broadcast it to SAM clients notifying them of, for example, information changes. The SAM also allows the applications which execute a particular service to be introduced into the system. Each application has a server component and a client component. The application server may execute all the time, while an application client may be downloaded to the HCT and executed only when the viewer requests the service be activated.

The SAM server provides an interface through which applications are placed on the network, services registered, a channel lineup specified, and the SAM information stored and modified. The SAM server may also allow changes to the SAM information table (as described herein below) to

be posted to the network together with a time specified by the cable operator.

The SAM client provides an interface through which applications may be activated and SAM information can be accessed. One functionality of the SAM client is the activation of an application client on the HCT, either to provide a specified service or because of a signaling message from the server.

As noted above SAM information includes at least five different tables: a Service Table stores information about all services available on the system and each service is identified by a specific service ID; a Display Channel Table ("DCT") provides an abstraction to match a display channel number to a service ID (and vice versa); a Split Channel Table supplements the DCT with information about split channels; a Bulk Table is provided for storing actual string and parameter data as well as attributes of each service. The data for each table may be transmitted from the server to the client by writing it into a binary file and then placing the file on a broadcast file system ("BFS") such as that disclosed in the aforementioned copending PCT Patent Application, the disclosure of which is incorporated herein by reference. Updates to the various table increments the tables' version number. Accordingly, the system will always access the most recent version of a particular table. This is important as some channels, for example the Split Channel Table, will change fairly regularly and indeed can change on a daily basis.

When the SAM server changes the SAM files being broadcast on BFS, the SAM client will receive a message from the SAM server via the HCT operating system. This message contains the current version number of each SAM table, as well as flags optionally specifying a "forced" update of each table. For each table, the SAM client will check the version number specified in the message versus the local table versions and only if they are different retrieve the file from the BFS and check the version number a second time (unless the "force" flag is set for that table, in which case the file on BFS is always checked). If a file version being transmitted on the BFS is different than the local file stored in the SAM client, the SAM client will update its tables using the new files.

The update process works such that while the SAM client is reading new files, the old files are still available to applications on the HCT. Only when the SAM client has completed reading any new tables does it actually update the current tables to the new information. During this very brief "swap", both old and new tables are locked such that the data cannot be accessed via the SAM client interface.

The update process is also robust such that the SAM client can handle the various non-deterministic aspects of the SAM server's use of the BFS. For example, the synchronization of the message being received at the client, the file being changed on the BFS server, and the file being changed as seen by the BFS client are all affected by network latency and could happen in different orders.

After receiving an information update, the SAM client will notify interested applications via the HCT OS that the SAM information has changed. To allow other components to update their service and channel related information, the SAM client must keep the last version of the replaced data tables in memory.

The various SAM information tables are transmitted in band, over QAM, for fast access by the SAM client during HCT boot. Copies of the tables, with the exception of the Logo Table, are also transmitted out-of-band, over QPSK. The out of band files are used by the SAM client during SAM information update such that the viewer's use of the HCT is not interrupted (access to in-band data requires use of the HCT tuner).

Referring now to FIG. 3 there is a block diagram representation of the Service Table used in the preferred embodiment of the Service Application Manager, all in accordance with the instant invention. The Service Table 300 contains the service identification information, with each service assigned a unique service ID. The header information at the beginning of the Service Table includes the table version 308 and the number of sub tables 310. This is followed by the service subtables. Each subtable 302 includes the number of subtable entries, the length of the service data segment, an index, and finally the service data segment. The index includes a pairing of a service ID and the offset into the data segment where the service data is actually found. Accordingly, if a particular subtable provides information relating to 25 different services, the index will include 25 blocks, each block corresponding to a single

service. The service IDs 306 across the entire Service Table are stored in increasing order, but are not necessarily contiguous. Each service subtable can store up to 64Kb of service data.

To find a service ID in the Service Table, a binary search is done first on the subtables to determine which subtable a service ID is in, and then within the index of the subtable to locate the offset of the service data in that subtable. The offset is then used to access the data directly.

Each service data record includes all of the service attributes. One such attribute is a description ID. The description ID is an index into the Bulk Table for the string describing the service. In one embodiment, each string is made up of three fields: (1) an ascii string decimal number specifying the length of the short description in characters; (2) a short description ascii string; and (3) a long description ascii string. For example, the following strings describe a service whose short description is "WTHR", and the long description is "The Weather Channel": "4WTHR The Weather Channel."

A second piece of data which is located in the data block 320 is a logo ID and which itself is an index into the Logo Table for the service's logo pixel map. An application Universal Resource Locator ("URL") ID is a third index into the Bulk Table for the URL string identifying the application client in the broadcast file system. The final attribute is an application dependent parameter, which is interpreted as a number (i.e., a source ID) or an index into the Bulk Table for a parameter string or parameter data.

In order to efficiently store service records for thousands of services, the invention specifies a record with variable-length fields. The idea is to use only as much memory for a field as is needed for the particular value of that field. The field Size attribute of the service is used to specify the size, in bytes, of each field. The field Size byte uses 2 bits to encoding the number of bytes minus 1 for each field. A value of "00" in a field means it is 1 byte, "01" means 2 bytes, etc. No matter what the actual field size, the access operations always return the field value in 32 bits. The access routines must operate at a byte level when retrieving fields larger than a byte because the data will not be word or half-word aligned. The format of the field Size byte is shown below:

```
field Size:   for(i = bit 0; i < 8; i++) {
                    description ID size - 1 : 2
                    logoId size - 1 : 2
                    applicationId size - 1 : 2
                    parameter size - 1 : 2
              }
```

Thus, each record varies in length from 5 to 17 bytes.

Accordingly, and referring now to FIG. 4, there is illustrated therein in a block diagram representation of the Bulk Table used in connection with the Service Application Manager, all in accordance with the instant invention. The Bulk Table 400 contains data relevant to the services, such as strings for descriptions, application URLs, and parameter data. As with the Service Table 300 of FIG. 3, the Bulk Table comprises several

initial entries 402, 404 as described above, followed by a plurality of bulk information subtables 406 and 408.

Each subtable includes the number of subtable entries, the length of the bulk data segment, an index, and finally the bulk data segment. The index includes a pairing of a bulk ID and the offset into the data segment where the bulk data is actually found. Accordingly, if a particular subtable provides information relating to 25 different bulk data entries, the index will include 25 blocks, each block corresponding to a single bulk data item. The bulk IDs across the entire Service Table are stored in increasing order, but are not necessarily contiguous. Each bulk subtable can store up to 64Kb of bulk data.

To find a bulk ID in the Bulk Table, a binary search is done first on the subtables to determine which subtable a bulk ID is in, and then within the index of the subtable to locate the offset of the bulk data in that subtable. The offset is then used to access the data directly.

The size and the contents of the Bulk Table itself depends on the size and type of information which is required to be stored therein. Several types of BulkData are defined in the following. The application URL is simply a NULL-terminated ASCII string. The service description is two concatenated NULL-terminated ASCII strings, the first being the short description and the second being the long description. For example, "WGNX\0CBS Atlanta\0" is a possible description string. A string is simply a NULL-terminated ASCII string. Arbitrary data can be stored in the Bulk Table and a pointer to that data handed out via an API in the

SAM Client. It is then up to the application client to interpret the content of the data.

Referring now to FIG. 5, there is illustrated therein a block diagram representation of the Display Channel Table used in connection with the Service Application Manager, all in accordance with the instant invention. The Display Channel Table 500 is used to map service IDs to channel numbers displayed to the viewer (Display Channel Number, or DCN). In one embodiment of a cable system using the SAM, the Display Channel Table can be specified on a per-hub basis. This allows different neighborhoods of subscribers to receive different channel lineups.

The Display Channel Table is constructed to allow optimal access time to determine the service ID for a particular service or the service ID for a particular DCN. Both transformations are required by applications executing in the HCT such as the channel navigator and the program guide.

The Display Channel Table begins with a version number 502, the number of valid channels in the channel index 504, and the length of the valid service index 506. This is followed first by a valid channel bitmap 508, containing a bit for each channel in the cable system. For each channel that is valid, the corresponding bit position is set in the valid channel bitmap. Next is a valid channel index 510, each entry associated with a valid channel in the bitmap, whose content is an index into the service/DCN index that follows. The service/DCN index contains an entry

for each valid service ID and Display Channel Number pair. Within each Display Channel Number in that pair

is a channel flag (the most-significant-bit of the DCN). This flag indicates whether or not the DCN is surfable, i.e. can be reached by the user incrementing or decrementing throughout the channel lineup. There exists a service ID/DCN pair for every combination of service and DCN, where a service can be associated with more than one channel.

These data structures can be better understood by explaining how the translation for service ID to DCN and vice-versa takes place. To translate from DCN to service ID, first the bit for the DCN in the valid channel bitmap is checked. If the bit is set, the channel is valid, and the index for that channel must be determined. The index is exactly Nth valid channel which the DCN happens to be, or the number of bits set in the valid channel bitmap up to and including the bit representing the DCN. This lookup is made compute efficient by using a table which stores the number of bits set in a single byte for each decimal value of that byte. Thus, the channel index can be determined by taking the decimal value of each byte in the valid channel bitmap, translating the decimal value to a "number of bits set" using the lookup table, and accumulating this count for each byte in the valid channel bitmap up to the byte for the DCN. The remaining bits in the byte where the DCN bit is located are added by shifting and masking.

The number of bits set is then directly the Nth valid channel for that DCN, which is directly the offset into the channel index for that DCN.

The channel index contains the offset into the service/DCN index for that DCN. Once this offset is known, the service ID for that DCN is the upper two bytes of the 32-bit service ID/DCN value. The total search time is then O(n) where n is the number of total possible channels. This is achieved without having to store for example an array of size total number of channels, using only an array of size total number of channels divided by eight (the bitmap) plus an array of size number of valid channels.

To look up a service ID for a DCN, a binary search on the service ID/DCN index 512 is done. This index is sorted in increasing order, such that the search is O(log (number of valid service/DCN entries)).

In addition to the services described above, the SAM supports the ability to split channels provided over the system. A split channel is one in which there is more than one service which is provided on that channel during a 24 hour period. One embodiment of the SAM may support split channels, where each of which shows two services, and which may change between those two services up to three times in a 24 hour period. For example if the channel is specified as a split channel with service X and service Y, starting at midnight the following splits are available: XY, XYX, XYXY. Split channels are identified in the Display Channel Table in both the channel index and the service ID/DCN index using a reserved constant. This indicates to the SAM client to lookup the information for the requested DCN in the Split Channel Table. There is always a Split Channel Table for each Display Channel Table in which a split channel is identified.

Accordingly, referring now to FIG. 6, there is illustrated therein a block diagram representation a Split Channel Table 600 for use in connection with the Service Application Manager, all in accordance with the instant invention. The Split Channel Table, like the other tables, includes a number of initial entries such as initial entry 602 and 604. Initial entry 602 is version which specifies the most recent version of the split channel table allowing the SAM system to know that it is working with the most recent version of information. The second entry 604 specifies the number of split channels in the channel lineup. Accordingly, and in FIG. 6, the number of split channels identified would be one as only one split channel record 606 is illustrated in split channel table 600. It is to be understood, however, that any number of split channels may be supported by this system, and the invention is not so limited. The split channel record 606 includes a number of pieces of information, including, for example, the DCN being split 608, the identities of the services which are splitting the channel 610 and 612, and a time flag 614 which specifies the hours at which services are being provided on the channel. These times are specified such that service 1 is on by default at midnight in any given day. Each time then marks a swap to service 2 and back, continuing according to the number of swaps. The core channel management application in the HCT uses this information such that service swaps take place automatically and are done by the client. This differs from existing analog systems where split channels are implemented by changing the content which is broadcast on a particular analog channel. The split

channel concept in this invention also allows channels to be split between video services and services of other media, such as text channels or web browsing time.

The final SAM information table present in the instant invention is the Logo Table as illustrated in FIG. 7. The Logo Table 700 stores service logo data. The SAM server provides two different Logo Tables on the BFS, both transmitted in band. One table provides the default set of logos known by the SAM Server upon deployment of the cable system, in the present embodiment the range of default logo IDs is from 1-255 and is published including the name of the logo. The data for the default logo images can be stored in the nonvolatile memory of the HCT such that they can be retrieved very quickly and rendered by applications in the HCT. The set of default logos will never change, nor will the data in the default Logo Table.

New logos registered with services by the SAM server are stored in another Logo Table. The SAM client always loads this table into memory on the HCT during initialization, and it can be updated like any of the other SAM information tables. Accordingly, the Logo Table initial entry 702 relates to version numbers of the table.

All logos are encoded by the SAM Server using an encoder that translates a single common image format such as GIF into the particular format that the SAM is transmitting (and decoding within the SAM Client).

Application clients can access the logo data in the SAM in several ways. First, an application client can ask for the logo ID that corresponds to a particular service. If the logo ID is stored by the application client (one of the default logos), it can then draw the appropriate logo using its own data. Otherwise, the application client can ask the SAM client for the logo pixmap data, width, and height in a format compatible with the HCT OS drawing capabilities. A LogoId of zero means no logo.

The structure of the Logo Table begins with a version number 702, number of logos 704 in the table, first logo ID in the table 706, and then the size of the logo data 708. Next is an index of logo data offsets 710, such that index equals the logo ID minus the starting logo ID of the table. The index for a logo contains the offset into the logo data segment where the actual image data for the logo is stored.

The primary functionality of the SAM is the activation of an application client on the DHCT, either to provide a specified service or because of a signaling message from the server. Typically the user of the DHCT will access services via the Display Channel Number (DCN). The SAM uses the Display Channel Table (DCT) to map a DCN to a ServiceId. "Split" channels are supported, such that one channel might provide multiple services, depending on the time of day. Given a service ID, the SAM Client first extracts the appropriate application URL BulkDataId from the Service record in the current Service Table, and then the actual URL string from the Bulk Table. It then asks the HCT Operating System ("OS") if the module with the application URL for the application is loaded

in the HCT memory. If not, it requests that the OS load the module using the application URL. Once the application code is resident in the HCT, the SAM client launches the application module as an OS application (it may be that the application has already been launched). It then asks the OS to activate the application, given the module handle--this brings the application into focus. Finally, the SAM client sends a kEt_Activate message to the application client, including the service ID and the service parameter from the Service Table.

Application clients can also be activated by a message sent from the server. The SAM client must register with the HCT operating system to receive SAM signaling messages. The content of these messages is an application URL to activate and the data to pass the application as a parameter. The SAM client thus provides a mechanism whereby an application client can be activated given the application URL and some data. If the data type is an integer value, meaning the parameter itself, then it is passed directly to the application identified by the URL via a kEt_Activate message. However, if the parameter is a string or data, then it must be stored by the SAM client locally and given a BulkDataId in the range reserved for private client use. The SAM client will activate the application client. The BulkDataId is passed as the parameter, and a special id is used to signify a service activated via a pass-thru message. The application client can then use the SAM client API to retrieve the data given the bulk ID. Depending on the application, the private bulk data might be a URL string, an actual string to use directly, or data. The

application client must be given the parameter type it is expecting; this must be verified by the SAM Server before the signaling message is sent. However, if the application client is expecting a string it must check whether the string is a URL or the content itself. If the application client is executing on behalf of the kSam_SignalingService, then it must delete the private bulk data when it suspends

The SAM client can be asked to construct a kEt_Notify event with supplied parameters and forward it to designated application clients. Again, this can be done via a service ID or an application URL. The notification event type is supplemented with event data particular to the notification being sent (such as kEd_SamDataUpdated), an ID (typically the service ID), and two parameters.

The SAM client provides a facility whereby application clients can be queried to determine whether particular services are currently authorized. The SAM will look up the application URL for the requested service ID in the Service Table, and send the application client a kEt_IsAuthorized event requesting an asynchronous reply to a queue created within the SAM client API. The SAM client will wait on that queue until a kEt_AsyncResponse event is delivered by the application client, and then return the result to the caller of the SAM API. Thus, while the internals of the authorization query are asynchronous, the SAM Client API is synchronous. It is up to the application client to determine if the service is authorized, using whatever means necessary.

Application clients can be suspended by ServiceId or directly via application URL. Application clients can also be suspended as a result of a signaling message from the SAM Server.

Accordingly, in the system illustrated in Figs. 1 and 2 it may be appreciated that the channel selection function of this system includes a plurality of channel cross reference tables as illustrated in Figs. 3-7. These tables cross reference settop terminal channels with a variety of television services, or other services, such as various types of video and audio programming, and online services such as web casting and E-mail. Selection of a particular channel transfers control of that specific application program, along with one or more appropriate parameters obtained from the cross reference tables, and activates the service associated with that selected channel. In sum, the cross reference tables in Figs. 3-7 are channel selection functions which enable the settop terminals to execute software and activate a variety of services. When a viewer of the system of FIG. 1 selects a channel, the HCT identifies the service associated with the selected channel from the Display Channel Table and then executes the appropriate application determined from the Service Table of FIG. 3.

Further, channel and service lineup can take place transparently to the viewer based on the data kept in the SAM client. This is important as subscribers often group together in blocks favorite types of programming so as to make access to those programs easier. In other words, a subscribers mapping of the settop terminal channels to television services

is maintained even if the cable service provider reassigns the cable channels over which those services are transmitted. Accordingly, when such reassignment occurs, updated versions of the ~~four~~ tables as specified hereinabove are transmitted from the SAM server to the SAM client, thus providing a transparent change in service channels for the SAM server operator through to the SAM client user. As an example, once parents configure channel settings to block particular services deemed inappropriate for children, a reassignment of cable channels over which those services are transmitted will not affect those services blocked status.

The manner in which requests for services are made by different applications within HCT are simplified by incorporating an application URL, similar to that used on the Internet, to uniformly identify application requested. In the context of services described hereinabove, it has been set forth that the service comprises a application and a parameter. The application in fact the URL to the executable application code, found either on the BFS or resident in HCT memory, while the parameter includes the data strings described herein above.

While the preferred embodiments of the invention have been illustrated and described, it will be clear that the invention is not so limited. Numerous modifications, changes, variations, substitutions and equivalents will occur to those skilled in the art without departing from the spirit and scope of the present invention as defined by the appended claims.

Claims

1. An apparatus for activating television services in a television broadcast system, said system comprising a system server device and a system client device, said apparatus comprising a subscriber input device for selecting a client television service, each said service including an application and a parameter; and

a central processing unit in communication with said client and server devices wherein said central processing unit selectively accesses a first table in response to the user selected television service; said first table selectively accessing at least a second and third table in order to identify the application and parameter associated with said service.

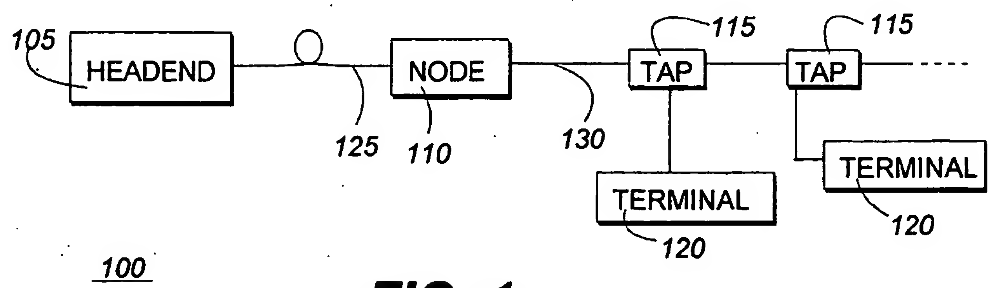
105
HEADEND
125
NODE
110
130
TAP
115
TAP
115
TERMINAL
120
TERMINAL
120
100

FIG. 1

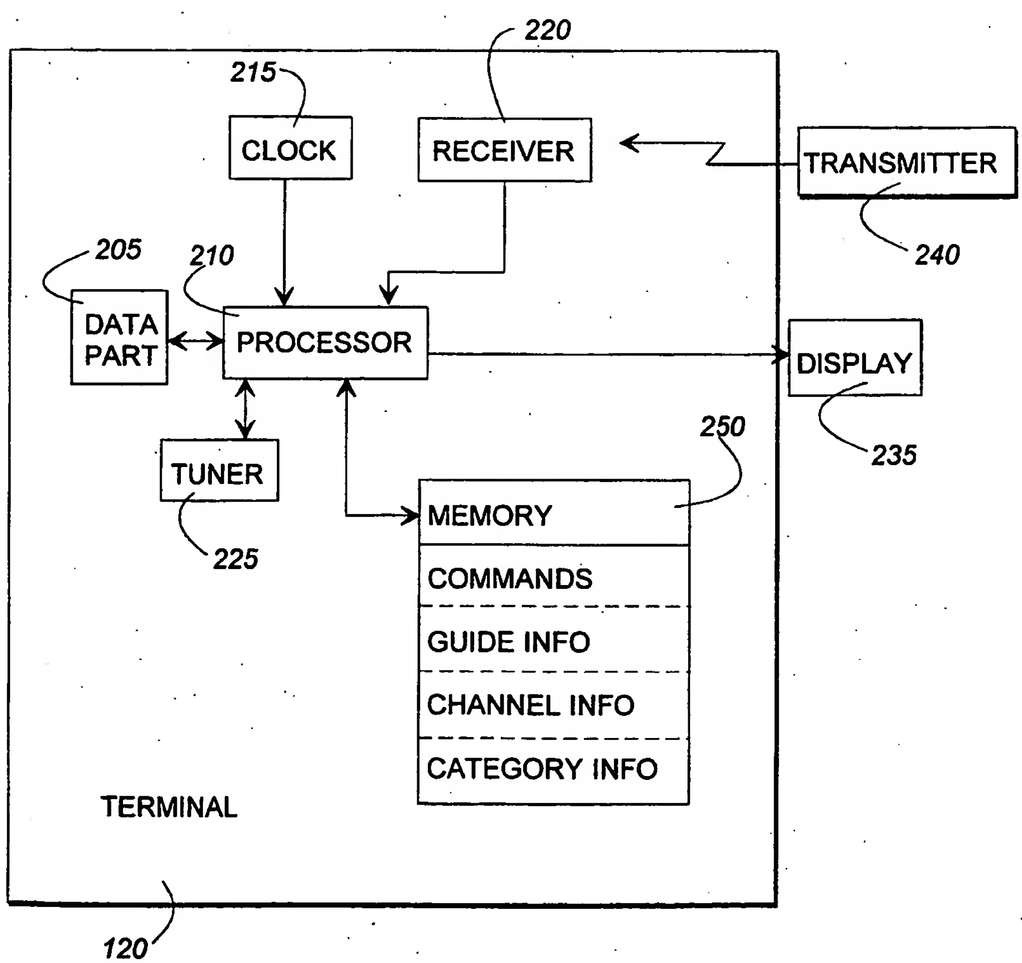
220
215
CLOCK
RECEIVER
TRANSMITTER
240
205
210
DATA PART
PROCESSOR
DISPLAY
235
250
TUNER
225
MEMORY
COMMANDS
GUIDE INFO
CHANNEL INFO
CATEGORY INFO
TERMINAL
120

FIG. 2

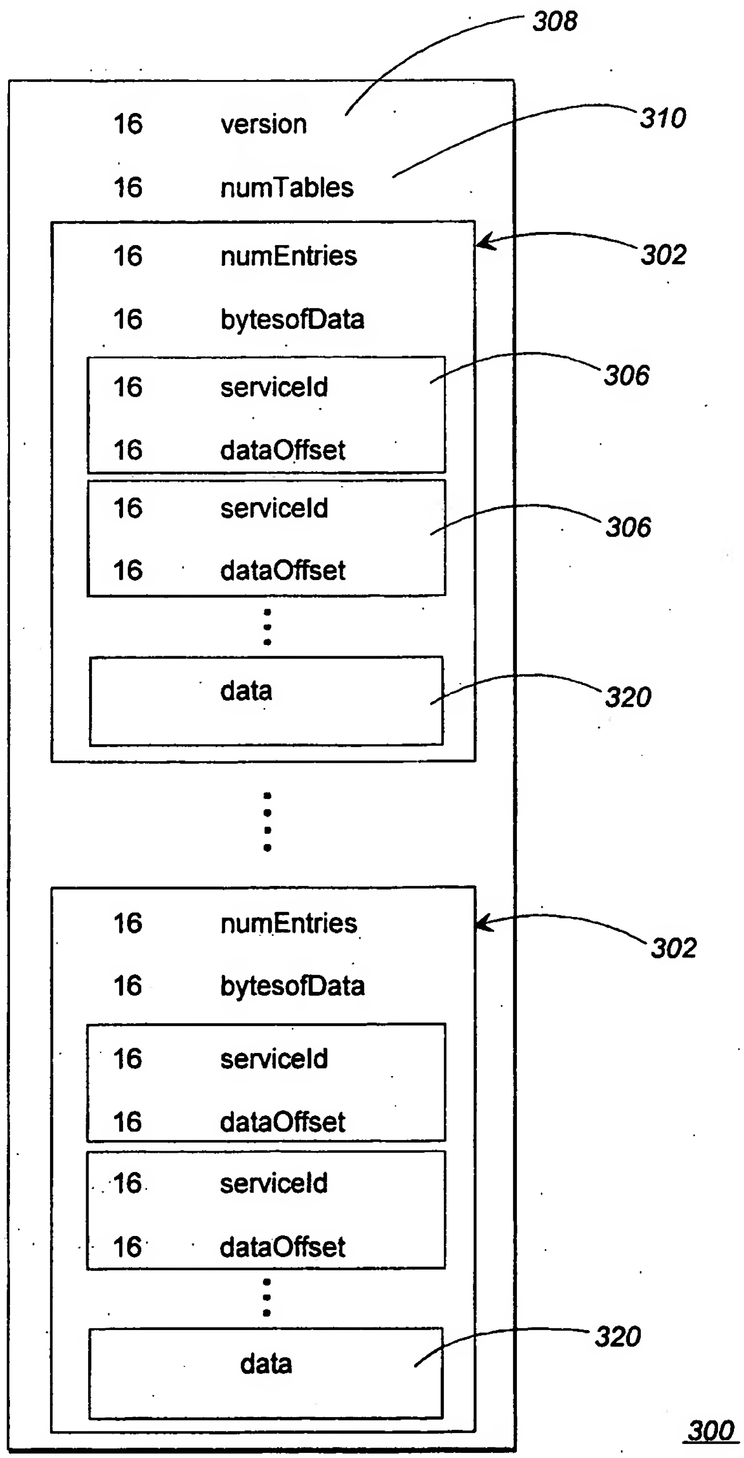
308
310
16 version
16 numTables
302
16 numEntries
16 bytesofData
306
16 serviceId
16 dataOffset
306
16 serviceId
16 dataOffset
320
data
302
16 numEntries
16 bytesofData
16 serviceId
16 dataOffset
16 serviceId
16 dataOffset
320
data
300

FIG. 3

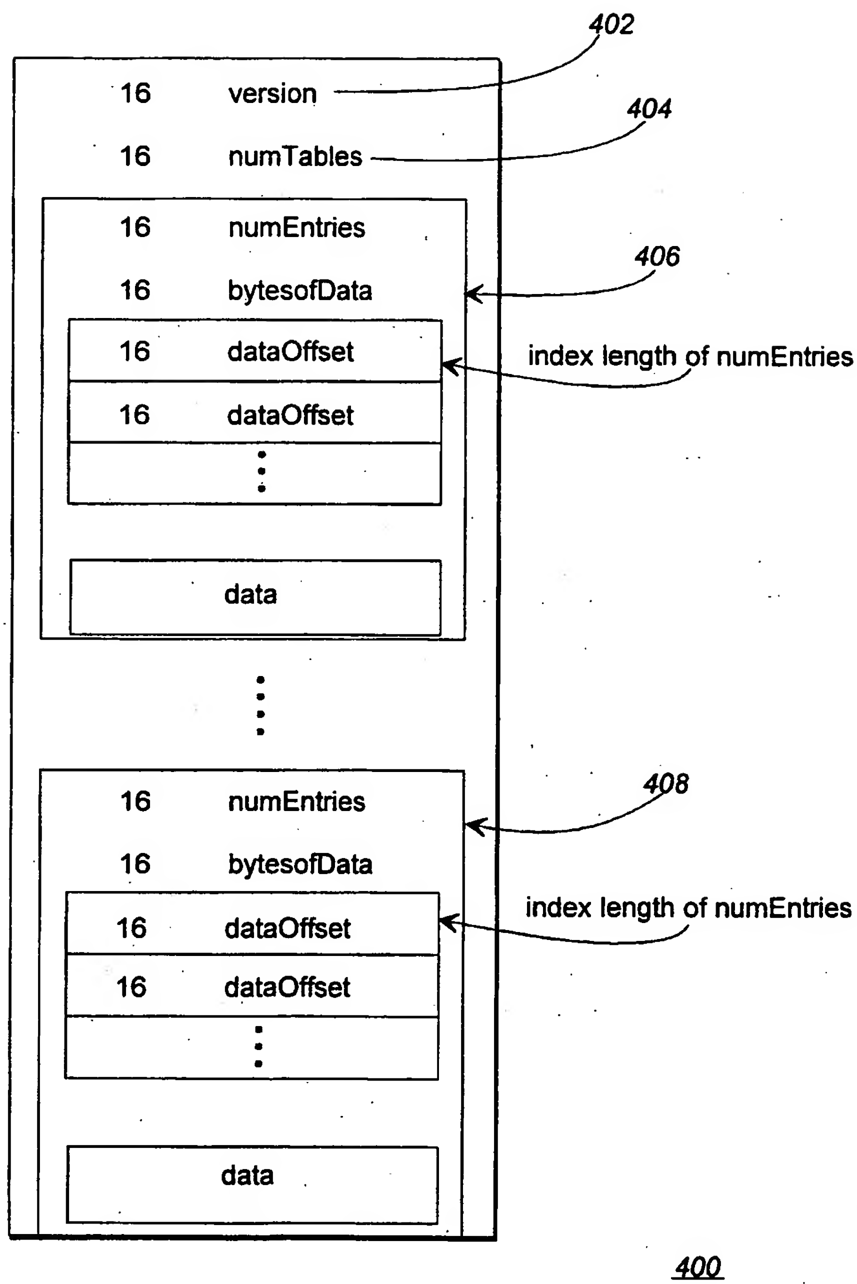
402
16 version
404
16 numTables
16 numEntries
406
16 bytesofData
16 dataOffset
index length of numEntries
16 dataOffset
data
408
16 numEntries
16 bytesofData
16 dataOffset
index length of numEntries
16 dataOffset
data
400

FIG. 4

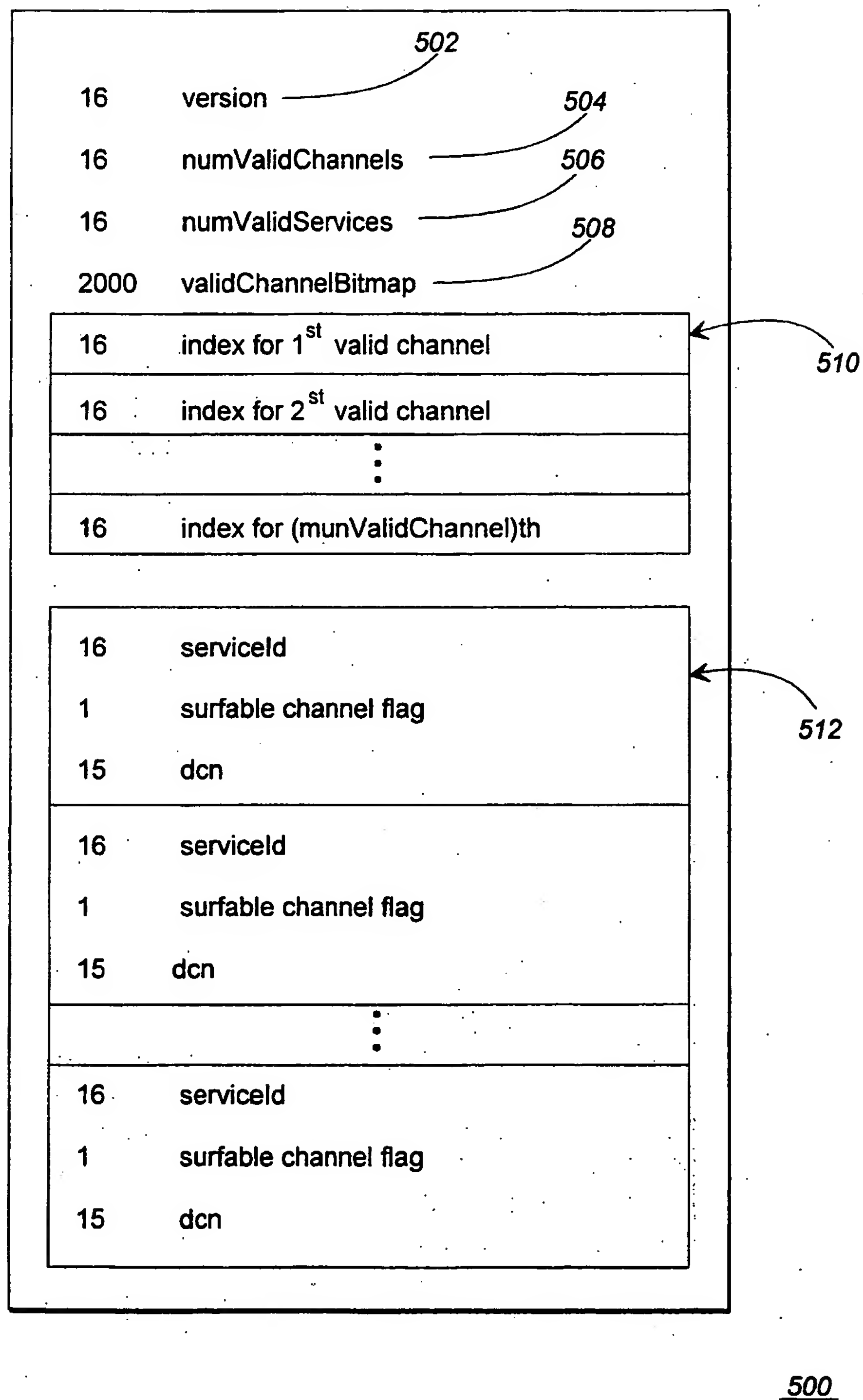
502
504
506
508
16 version
16 numValidChannels
16 numValidServices
2000 validChannelBitmap
16 index for 1st valid channel
16 index for 2st valid channel
16 index for (munValidChannel)th
510
16 serviceId
1 surfable channel flag
15 dcn
16 serviceId
1 surfable channel flag
15 dcn
16 serviceId
1 surfable channel flag
15 dcn
512
500

FIG. 5

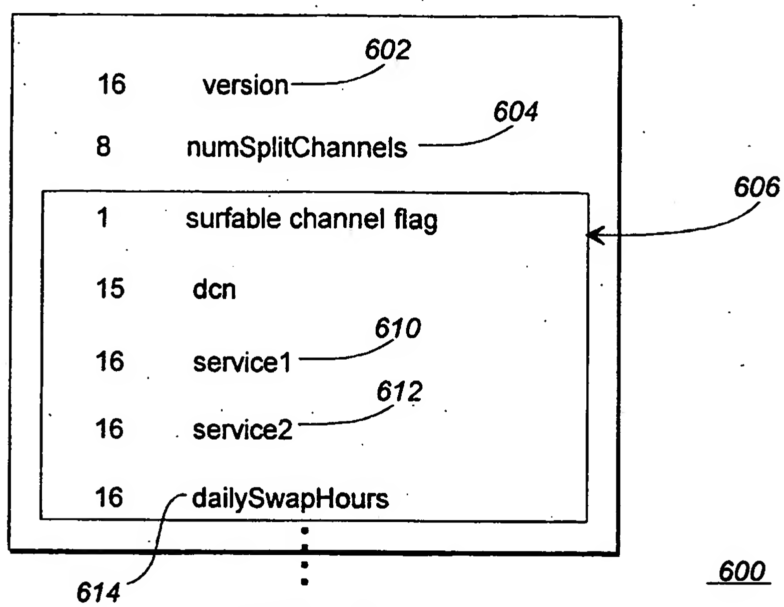
602
16 version
604
8 numSplitChannels
606
1 surfable channel flag
15 dcn
610
16 service1
612
16 service2
16 dailySwapHours
614
600

FIG. 6

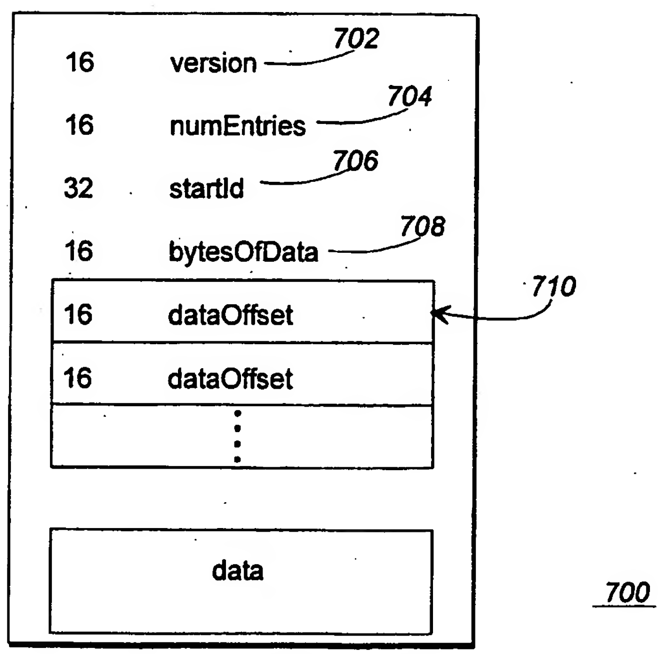
702
16 version
704
16 numEntries
706
32 startId
708
16 bytesOfData
710
16 dataOffset
16 dataOffset
data
700

FIG. 7

INTERNATIONAL SEARCH REPORT

Inte tional Application No
PCi/US 99/09278

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04N7/173

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04N G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 95 15658 A (DISCOVERY COMMUNICAT INC) 8 June 1995 (1995-06-08) page 10, line 1 - page 16, line 15 page 18, line 26 - page 21, line 33	1
Y	WELCH B ET AL: "PREFIX TABLES: A SIMPLE MECHANISM FOR LOCATING FILES IN A DISTRIBUTED SYSTEM" INTERNATIONAL CONFERENCE ON DISTRIBUTED COMPUTING SYSTEMS, CAMBRIDGE, MASS., MAY 19 - 23, 1986, no. CONF. 6, 19 May 1986 (1986-05-19), pages 184-189, XP000011342 INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS the whole document	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 July 1999	03/08/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Greve, M

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/09278

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		JP 9506225 T	17-06-1997
		WO 9515649 A	08-06-1995